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(54) A unit for feeding, cutting and wrapping film, in machines for packaging commodities.

(57) The wrapping station comprises a pair of vertical walls (14) in mutual opposition on respective sides of a conveyor (13), which carry respective sets of sprockets (15) positioned at different heights in relation to the conveying surface and driving a pair of looped chains (16) interconnected by cross rails (11) cycling through at least four positions : a first, in which the film (2) is restrained by a pack (6) of commodities to be wrapped and taken up by the rail (11), a second in which the film (2) is elevated by the rail above the pack (6), hanging in two folds of combined length equal to the required wrapping length, and a third in which the rail (11) descends a short way, allowing the film to be cut to the required length, the cut sheet (S) is then drawn forward by the rail over the commodities and released onto the leading face (F) of the pack in a fourth position. The sprockets (15) are mounted to height adjustable supports (24), and can thus be repositioned to suit the packaging format.

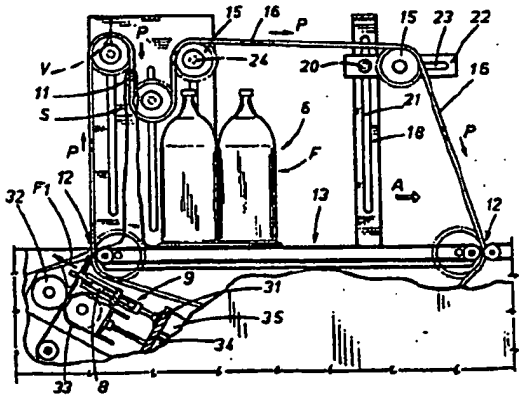

FIG 2

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The present invention relates to a unit for feeding and cutting and wrapping a heat-shrinkable film material, in machines for packaging commodities.

Currently, automatic machines of the type referred to above consist in a line comprising intermediate stations, conventional in embodiment, by which the commodities are positioned and ordered into a given formation, and further stations toward the end of the line by which the formed groups of commodities are enveloped in a plastic wrapping.

The function of the intermediate positioning and formation stations is to arrange the commodities in groups (the number of single commodities per group being dependent on the dimensions, and on the type or format of packaging adopted), and to direct the groups thus formed toward the wrapping stations; these are linked by means of a transfer station consisting substantially in a conveyor belt along which the groups of commodities advance ultimately into the wrapping area.

The wrapping stations are equipped with a system for feeding heat-shrinkable plastic material (the material used to form the aforementioned wrappings) decoiled from a reel by a station located below the surface along which the commodities advance. Such a system typically comprises an infeed belt by which the film is advanced in a direction concurrent with the path followed by the commodities, to the point of encountering the conveying surface on which the commodities are supported; at this point, the film is taken up and guided by a frame with transversely disposed rails carried between parallel chains, and passed forward over a relative group of commodities in such a way that the group, still in motion, is enveloped by the film as the film itself is drawn out in the direction of movement of the conveying surface. The wrapping operation terminates with the ends of the film united an overlapping joint, and the vertical side faces of the group of commodities left partly exposed. Thereafter, the film is shrunk onto the commodities by the application of heat in a manner familiar to persons skilled in the art.

The prior art embraces a variety of constructional solutions in respect of the unit by which film is fed, cut and wrapped around a group of commodities.

A first such solution comprises a cutting device, located preceding the film infeed belt in relation to the path followed by the groups of commodities and comprising a rotary cutter, which is disposed transversely to the longitudinal axis of the film material and compasses its entire width; the cutter is set in motion synchronously with other movements of the line in such a way that the continuous film is cut into discrete portions of predeterminable length, thereby creating the single wrapping sheets in which the commodities are enveloped.

A second solution (proposed by the same applicant) comprises a cutter which rotates continuously while ascending and descending in alternation and in time with other movements of the machine; more exactly, the cutter continues to turn, but remains normally in a raised position outside the infeed trajectory and approaches the film only when lowered into an operative cutting position, moving at a prescribed velocity and engaging the film in combination with a striker, in such a way as to produce the required length of cut.

In a third solution, which affords an improvement on the second solution (see application 3778 A/90 for Italian patent, filed by the same applicant), the unit comprises a cutter supported and set in motion by means consisting in a pair of parallel and mutually opposed chain loops associated with corresponding pairs of sprockets of which one is driven synchronously with other movements of the machine. The cutter is supported rigidly on each side by the chains and carried continuously through a substantially circular trajectory, in the course of which the sharp edge is brought cyclically into a position of interference with the film, poised perpendicularly against a surface over which the film is conveyed and entering the cut at a velocity greater than the velocity of the advancing film.

Shortcomings of varying nature are betrayed by all of the aforementioned solutions. The first presents functional drawbacks attributable to the fact that the cutting device utilizes a drive incorporating a brake-clutch device activated in conjunction with a set of wheels in such a way that the cutter can be immobilized in a position of non-interference with the decoiling strip, then activated cyclically on the basis of the required length of sheet, passing through one full revolution with each cycle; this cyclical indexing type of movement can lead to loss of timing or irregulities in operation of the drive components forming part of the cutting station, besides significantly limiting the effectiveness of the cutter when functioning at high speeds. Still more negative is the aspect of cost which, being greater in the case of the arrangement in question, restricts its application to machines with higher specifications.

In the second solution mentioned, the operational effectiveness of the entire cutting station is much improved (in particular with respect to the speed of execution and the number of discrete lengths of film cut per unit of time), though the arrangement warrants useful application only in the context of a machine with high output capacity requiring high performance from the cutting device, given the use of cams to determine the timing of the cut.

The aim of the third solution referred to is one of gaining a reduction in costs while seeking to detract as little as possible from the functional efficiency with which discrete lengths of film are cut in continuous cycle, though the dimensions of the station and the arrangement adopted are in part a reflection of the sec-

ond solution mentioned, such that any advantage is again restricted to machines typified by higher costs and specifications.

An additional drawback common to all the solutions described is discernible in the lack of practical advantage afforded by the wrapping station: more exactly, the guide frame which carries the film is designed to accommodate groups of commodities with fixed proportions (i.e. the size and number of the commodities, which generally will be standard), whereas when changing to a non-standard size, or to customized packaging formats, the line must be shut down completely and the entire wrapping mechanism replaced (or at very least, the chain sprockets or the computer software used to control the process), the effects of which are clearly reflected in down time and lost production. In other words, the prior art solutions outlined above are somewhat rigid in design and not readily adaptable to changes in the size of package or commodity handled, particularly when variable over a wide range.

The object of the present invention is to overcome the aforementioned drawbacks by providing a unit for feeding, cutting and wrapping film, in machines for packaging groups of commodities, which is both practical, and structured in such a way as to allow high speed operation whilst ensuring that the film is cut accurately and wrapped precisely and safely around the relative group of commodities, besides enabling a swift adaptation to different packaging formats in the case of the wrapping station.

The stated object is realized in a feeding, cutting and wrapping unit as characterized in the appended claims, of which a preferred embodiment will now be described in detail by way of example with the aid of the accompanying drawings, where:

- figs 1, 2 and 3 are side elevations showing a part of the feeding, cutting and wrapping unit according to the present invention, with certain elements omitted better to reveal others, each illustrating a respective configuration assumed in the course of wrapping a group of commodities;
- fig 4 shows the feeding and cutting stations of a unit according to the present invention, seen in side elevation and on larger scale, with certain parts omitted better to reveal others;
- fig 5 is a lateral perspective of the wrapping station in a unit as illustrated in the preceding drawings.

With reference to the accompanying drawings, the unit disclosed is designed to operate in machines for packaging commodities, of the type comprising conventional stations at which single commodities are ordered into groups 6, also a decoiler 1 (see fig 4), by which a continuous film 2 of wrapping material (heat-shrinkable plastic) is wound off a reel 3 mounted to a supporting structure 4 integral with the machine, and supplied at a predetermined rate of feed, synchronously with other movements of the machine, to a wrapping station denoted 7. The decoiler 1 is located beneath a conveying surface 5 along which the groups 6 of commodities advance in the direction denoted A in fig 4, and operates in conjunction with a cutter 8 disposed transversely to the conveying surface 5 and associated with supporting and actuating means 9 designed to ensure that the cutting stroke is synchronized with other movements of the machine, and the continuous film 2 thus divided into discrete wrapping sheets S of a predeterminable length.

The wrapping station 7 is equipped with enveloping means 10 by which successive sheets S of film are unfolded in an elevated position through the agency of transversely disposed rails 11 afforded passage by a pair of transverse slots 12 located at either end of a table 13 forming a part of the station 7; in effect, the group 6 of commodities is enveloped from overhead by the action of the rails 11, while the commodities themselves impinge on the leading end of the film 2 following its emergence from the slot 12 which precedes the wrapping station 7 in the conveying direction A.

More exactly, the enveloping means 10 comprise a pair of vertical walls 14 (see figs 1, 2, 3 and 5), positioned on opposite sides of the feed station beneath and disposed in mutual opposition on either side of the conveying surface 5. Each such wall 14 carries a plurality of sprockets 15 positioned at different heights one from another, relative to the conveying surface 5, and serving to set in motion one of a pair of chains 16 associated respectively with the two walls 14; preferably, each wall 14 carries three sprockets 15 of which the first and the third, considered in relation to the conveying direction A, are positioned higher than the middle sprocket.

The two walls 14 aforementioned are connected to a second pair of vertical walls 18, positioned close to the slot 12 beyond the wrapping station 7, each of which carries a fourth sprocket 19 in mesh with a corresponding chain 16 and rendered adjustable for height in relation to the conveying surface 5 by association with a pin 20 slidably accommodated in a vertical slot 21 afforded by the respective wall 18. Each of these additional sprockets 19 can also be moved closer to or farther away from the three sprockets 15 on the same side, to which end the relative pin 20 is associated with a horizontal bar 22, likewise affording a slot 23, in which the sprocket 19 itself is slidably mounted; in this way the length of the active branches of the chains 16 can be adjusted to accommodate the proportions of the group 6 of commodities.

The two chains 16 operate as closed loops, of which one branch 16n (fig 4) remains below the conveying surface 5 and plays no active part in the wrapping operation, and are interconnected by a plurality of the aforementioned transversly disposed rails 11.

With the sprockets 15 and 19 set in rotation, the single rail 11 is made to assume a succession of positions in relation to the conveying surface 5, determined by the trajectory P of the chains 16: a position of interception (see fig 1), in which the rail engages the continuous film 2 following the passage of the group 6 of commodities onto the table 13 and into contact with the leading end of the film 2 fed into the wrapping station 7 by the decoiler 1; a position of vertical elevation (shown by the phantom line denoted V in fig 2), in which the decoiling film 2 is drawn to a height above that of the group 6 of commodities, and hangs in two effectively parallel folds of combined length substantially equal to the length needed to envelop the group of commodities 6; a position of reduced height in relation to the conveying surface 5 (the result of the second sprocket 15 being lower than the first) coinciding with a pause in the decoiling action during which the film 2 is cut; and finally, a position of release: in the situation of fig 2, in fact, with the rail 11 positioned at the reduced height, the group 6 of commodities advances along the table 13 no longer carrying with it the entire length of continuous film 2 fed into the station, but only the leading fold hanging from the rail 11, thus allowing the cut which separates the sheet S.

From this position, the rail 11 will be traversed substantially parallel to the conveying surface 5, with the result that the sheet S is drawn forward and ahead of the advancing group 6 of commodities, to be released ultimately onto the upright face F nearest the slot 12 beyond the wrapping station 7; thereafter, the enveloped group 6 of commodities is transferred to a station where the film is shrunk tight against the contents by the application of heat (a conventional process not illustrated in the drawings).

The decoiler 1 (fig 4) comprises at least one pair of horizontally disposed power driven rollers 27 and 28 (naturally, the arrangement might include at least one additional freely revolving roller 28r so as to increase the length of film decoiled before encountering the cutter 8), positioned beneath the conveying surface 5 and supporting the reel 3, also a third roller 29 which is cradled in a loop of the already decoiled film 2, and suspended thus at a selected distance below the conveying surface 5 in such a way as to ensure that a quantity of film at least double the length needed to envelop a single group 6 of commodities will remain decoiled at any given moment; to verify that the quantity of film 2 in question is constantly maintained, the decoiler further comprises monitoring means 30 positioned adjacent to the third roller 29 and consisting in a conventional photocell 30f mounted to the end of a cantilevered L-shaped arm 30b, likewise adjacent to the third roller 29, of which the function is to deactivate the decoiler 1 if excited by the passage of the third roller 29 when elevated as the result of increased tension occasioned either by depletion of the film or by a defective decoil action.

The supporting and actuating means 9 associated with the cutter 8 (see fig 2) comprise a cross member 31 extending the full width of the conveying surface 5 and secured to the supporting structure 4 in a position near to the slot 12 preceding the wrapping station 7. The cross member 31 carries a first horizontally disposed roller 32, which will be clutch-coupled and preferably rubber faced, by which the plastic film 2 is advanced synchronously with other movements of the machine, and a second roller 33 disposed tangentially to and capable of movement toward and away from the first, through the agency of a plurality of pneumatic cylinders 34 angled in relation to the conveying surface 5 and supported by the cross member 31, such that the continuous film 2 can be allowed a free passage toward the slot 12.

Positioned above the two rollers 32 and 33, and disposed perpendicular to a plane occupied by the portion of continuous film 2 passing between the rollers 32 and 33, the cutter 8 is associated with a plurality of pneumatic cylinders 35 mounted to the cross member 31 and capable thus of movement (in the direction of the arrow denoted F1) between a non-operative retracted position, distanced from the film 2, and an operative position in which the sharpened edge impinges on and severs the film 2, penetrating a matching groove 36 positioned on the opposite side of the material, in such a way as to separate the single sheet S.

The film 2 is afforded additional support by a flat rigid guide 37 mounted to the cross member 31 in a position above the first and second rollers 32 and 33, between the cutter 8 and the slot 12 preceding the wrapping station 7, of which the purpose is to maintain the film 2 in the correct feed position as each successive sheet S is separated.

17 denotes means by which to adjust the height of the three sprockets 15 carried by each wall 14 of the enveloping means 10, or rather their respective distances above the conveying surface 5, according to the proportions of the group 6 of commodities to be wrapped. Such means 17 comprise a plurality of pins 24 each permanently associated with a relative sprocket 15, insertable through and accommodated slidably within corresponding vertical slots 25 of which the edges are flanked by respective graduated scales marked on the relative vertical wall 14, and means 26, interacting with the outermost end of each pin 24, by which to secure the sprocket 15 at a selected height. In the example illustrated, such means 26 consist in single clamp handles 26m worked manually by the operator of the machine, though the option obviously would exist of adopting automatic systems (e.g. servomotors, connected to electronic media by which the entire machine is governed).

Also illustrated, in fig 4 of the drawings, is a system of idler sprockets 50, 51 and 52 controlled by a

rocking lever B, of which the function is to take up slack and thus maintain the correct tension in the chain loop even when changing the position of the sprockets 15, without necessarily having to change the chains 16 themselves.

The unit disclosed affords an advantageous level of output per unit of time, unvarying precision in the movements which contribute to wrapping a group of commodities, and above all, notable flexibility in adaptation to different packaging formats, with the necessary change operations effected swiftly and compassing a wide range of dimensions: all of which combined with significant economy of the unit as a whole.

Claims

1) A unit for feeding, cutting and wrapping film material in machines for packaging commodities, comprising: a decoiler (1), by which a film (2) of plastic material is unwound continuously from a reel (3) and advanced at a predetermined rate of feed synchronously with other movements of the machine, mounted to a supporting structure (4) of the machine and positioned substantially beneath a surface (5) along which groups (6) of commodities are conveyed in a horizontal direction (A) to a wrapping station (7); a cutter (8), associated with supporting and actuating means (9) and positioned transversely to the machine beneath the conveying surface (5), by which the continuous film (2) is engaged synchronously with other movements of the machine in such a way as to cut discrete sheets (S) of predeterminable length; enveloping means (10), onto which successive sheets (S) of film are taken up and unfolded in an elevated position by the action of transversely disposed rails (11) passing through at least one pair of slots (12) positioned respectively at each end of a table (13) forming part of the wrapping station (7), in such a manner that the group (6) of commodities is enveloped from above while impinging on and restraining a leading extremity of the sheet (S) of film fed through the slot (12) which precedes the wrapping station (7) in relation to the conveying direction (A), characterized
in that the enveloping means (10) comprise a pair of vertical walls (14) positioned on opposite sides of the wrapping station, and in mutual opposition on either side of the conveying surface (5), each carrying a plurality of sprockets (15) positioned at different heights one from another relative to the conveying surface (5), of which at least the first, in relation to the conveying direction (A), is positioned higher than the second and serves to set in motion one of a pair of looped chains (16) arranged with one non-active branch (16n) located permanently below the conveying surface (5), driven synchronously with other movements of the machine and interconnected by a plurality of transversely disposed rails (11) spaced apart one from the next such that each can be made to assume a succession of identifiable positions relative to the conveying surface (5):

- a) a position of interception, in which the rail (11) engages the continuous film (2) following the passage of the group (6) of commodities onto the conveying surface (5), impinging on and restraining the leading end of the film (2) advanced by the decoiler (1);
- b) a position of vertical elevation, in which the decoiling continuous film (2) is drawn to a height greater at least than the group (6) of commodities and hangs in two substantially vertical parallel folds of combined length not less than the length needed to envelop the group (6) of commodities;
- c) a position of reduced height in relation to the conveying surface (5), coinciding with a pause in the decoiling action during which the film (2) is cut to produce a single wrapping sheet (S);
- d) a position of release assumed after a further movement substantially parallel to the conveying surface (5), whereby the sheet (S) is drawn forward and ahead of the advancing group (6) of commodities and freed ultimately into the path of the upright face (F) of the group nearest to the slot (12) beyond the wrapping station 7; and in that it comprises means (17) of adjustment associated with and serving to select the height of the plurality of sprockets (15) in relation to the conveying surface (5), according to the proportions of the group (6) of commodities to be wrapped.

2) A unit as in claim 1, wherein the sprockets (15) carried by each vertical wall (14) are three in number, comprising a first and a third positioned higher than the second, viewed in relation to the conveying direction (A), and enveloping means (10) comprise a second pair of vertical walls (18), connected to the first pair of vertical walls (14) and located nearer to the slot (12) positioned beyond the wrapping station (7), each carrying at least one further sprocket (19) in mesh with the corresponding chain (16) which is adjustable for height in relation to the conveying surface (5) and rendered capable of movement toward and away from the remaining sprockets (15) by means of a pin (20) slidably accommodated in a vertical slot (21) afforded by the respective second wall (18) and connected to a horizontal bar (22) also affording a slot (23) in which the further sprocket (19) is slidably mounted, thereby allowing adaptation of the chains to the proportions of the group (6) of commodities.

3) A unit as in claim 1, wherein adjustment means (17) comprise a plurality of pins (24) each associated with a relative sprocket (15), insertable through and accommodated slidably within corresponding vertical slots (25) afforded by the respective vertical walls

(14), also means (26) interacting with the outermost end of each pin (24), by which to secure the relative sprocket (15) at a selected height.

4) A unit as in claim 1, wherein the decoiler (1) comprises at least one pair of horizontal power driven rollers (27, 28) positioned beneath the conveying surface (5) and supporting the reel (3), a third horizontal roller (29) supported by the continuous film (2) and suspended at a selected distance below the conveying surface (5) in such a way that a quantity of film at least double the length required to envelop a single group (6) of commodities will remain permanently decoiled, and monitoring means (30) positioned adjacent to the third roller (29), of which the function is to deactivate the decoiler (1) on sensing the passage of the roller (29) when elevated as the result of increased tension in the film (2).

5) A unit as in claim 1, wherein the cutter (8) is associated with supporting and actuating means (9) comprising a cross member (31) extending the full width of the conveying surface (5) and secured to the supporting structure in a position near to the slot (12) preceding the wrapping station (7), and, mounted to the cross member (31), a clutch-coupled first horizontally disposed roller (32) by which the film (2) is advanced synchronously with other movements of the machine, and a second roller (33) disposed tangentially to and rendered capable of movement toward and away from the first roller (32) through the agency of a plurality of pneumatic cylinders (34) angled in relation to the conveying surface (5) and supported by the cross member (31), thereby allowing the continuous film (2) to decoil toward the slot (12), also a further plurality of pneumatic cylinders (35) mounted to the cross member (31), by which the cutter (8) is supported in a position above the rollers (32, 33), disposed perpendicular to a plane occupied by the decoiling continuous film (2) and rendered thus capable of movement between an at-rest position, distanced from the film, and an operative position in which the cutting edge penetrates through the film (2) and into a matching groove (36), in such a way as to separate the single sheet (S).

6) A unit as in claim 5, wherein supporting means (9) further comprise a flat rigid guide (37) mounted to the cross member (31) in a position above the first and second rollers (32, 33), between the cutter (8) and the slot (12) preceding the wrapping station (7), by which the film (2) is maintained in a given feed position as the sheet (S) is separated.

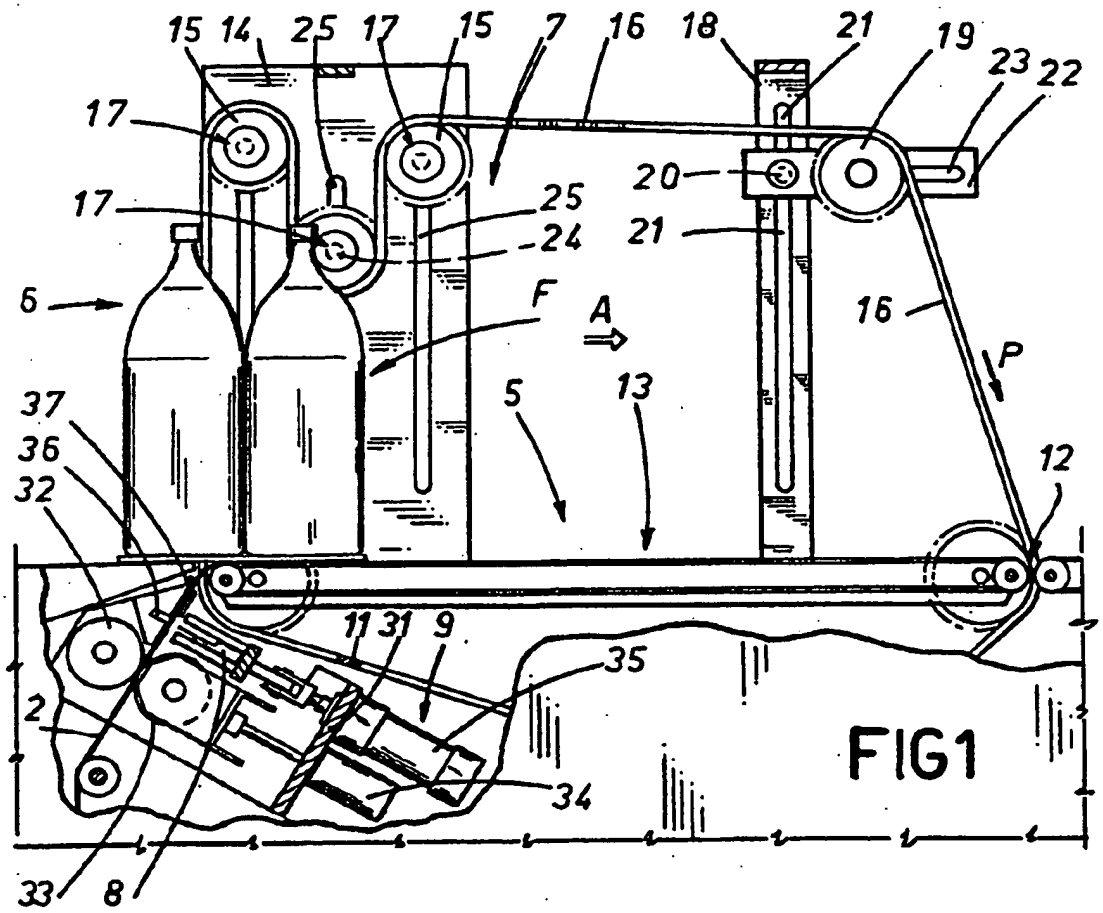


FIG1

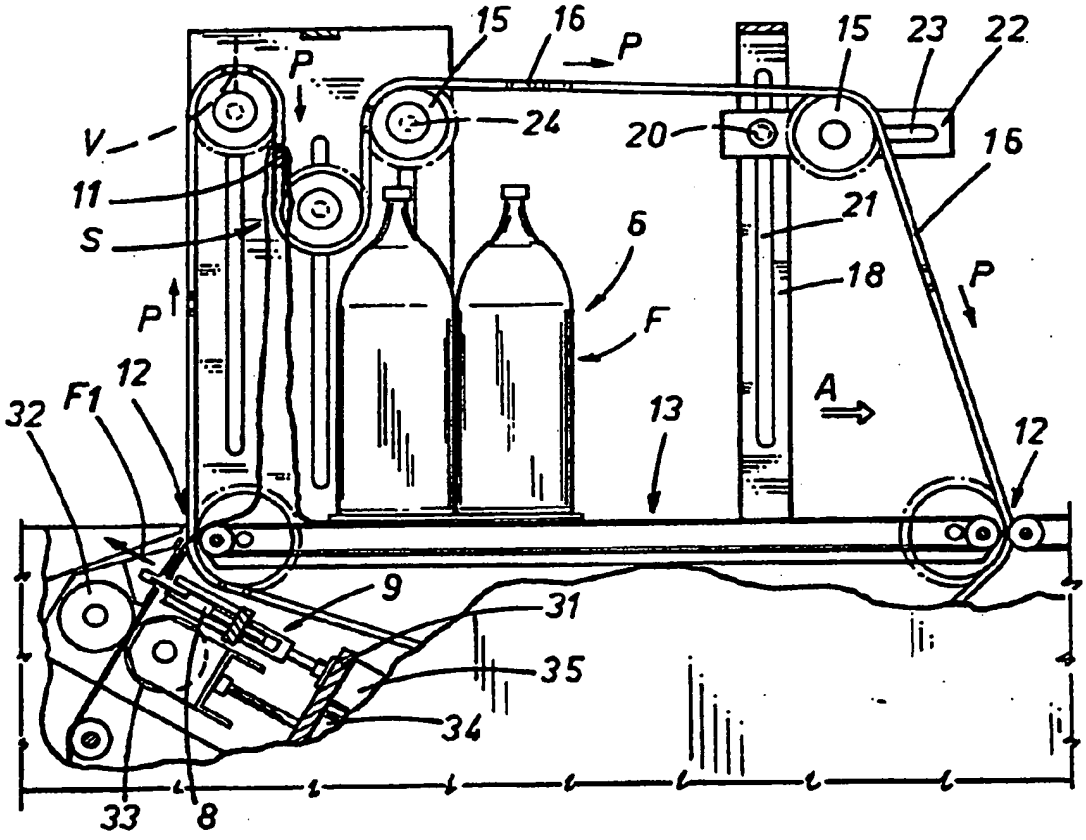
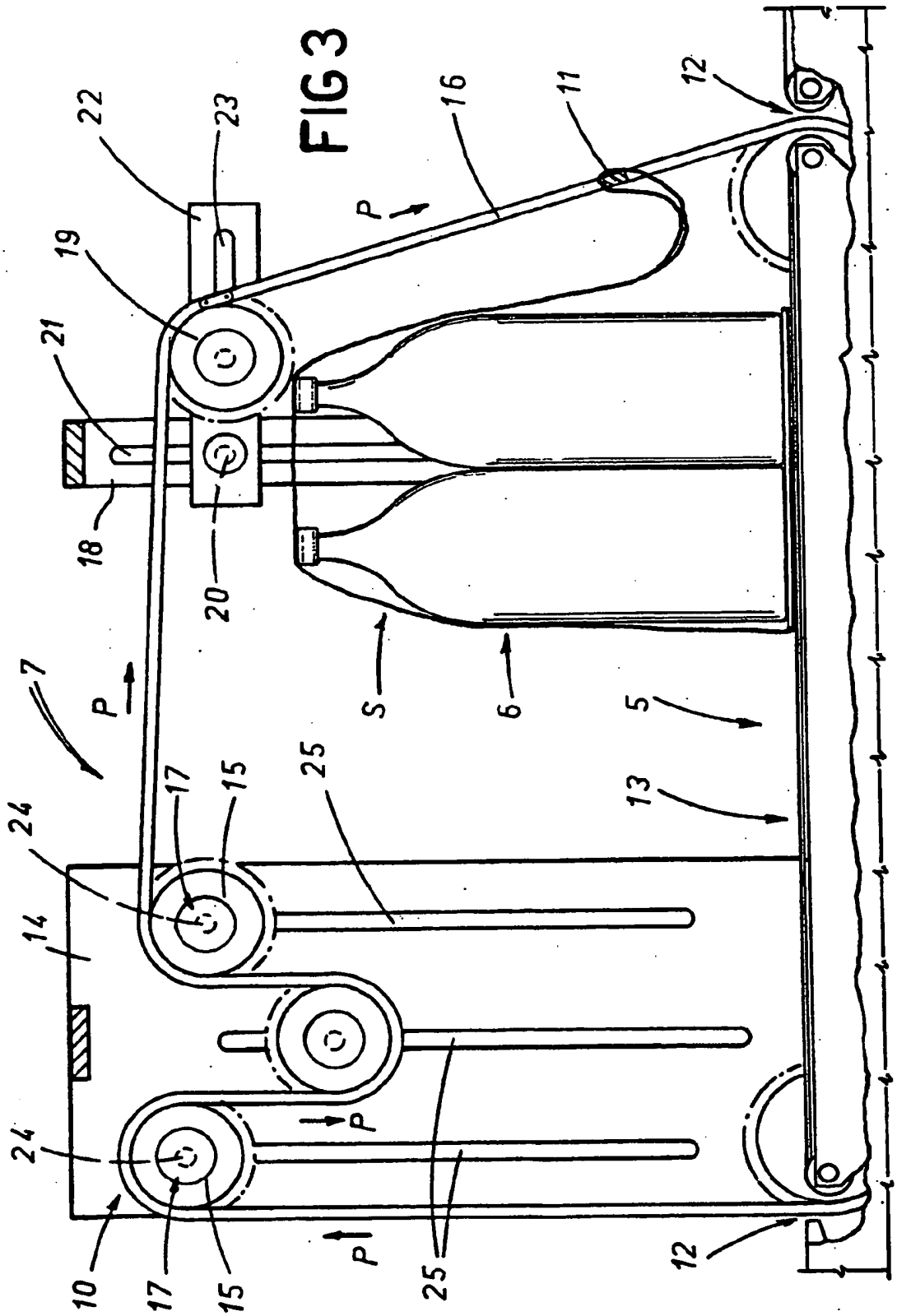


FIG2

FIG3



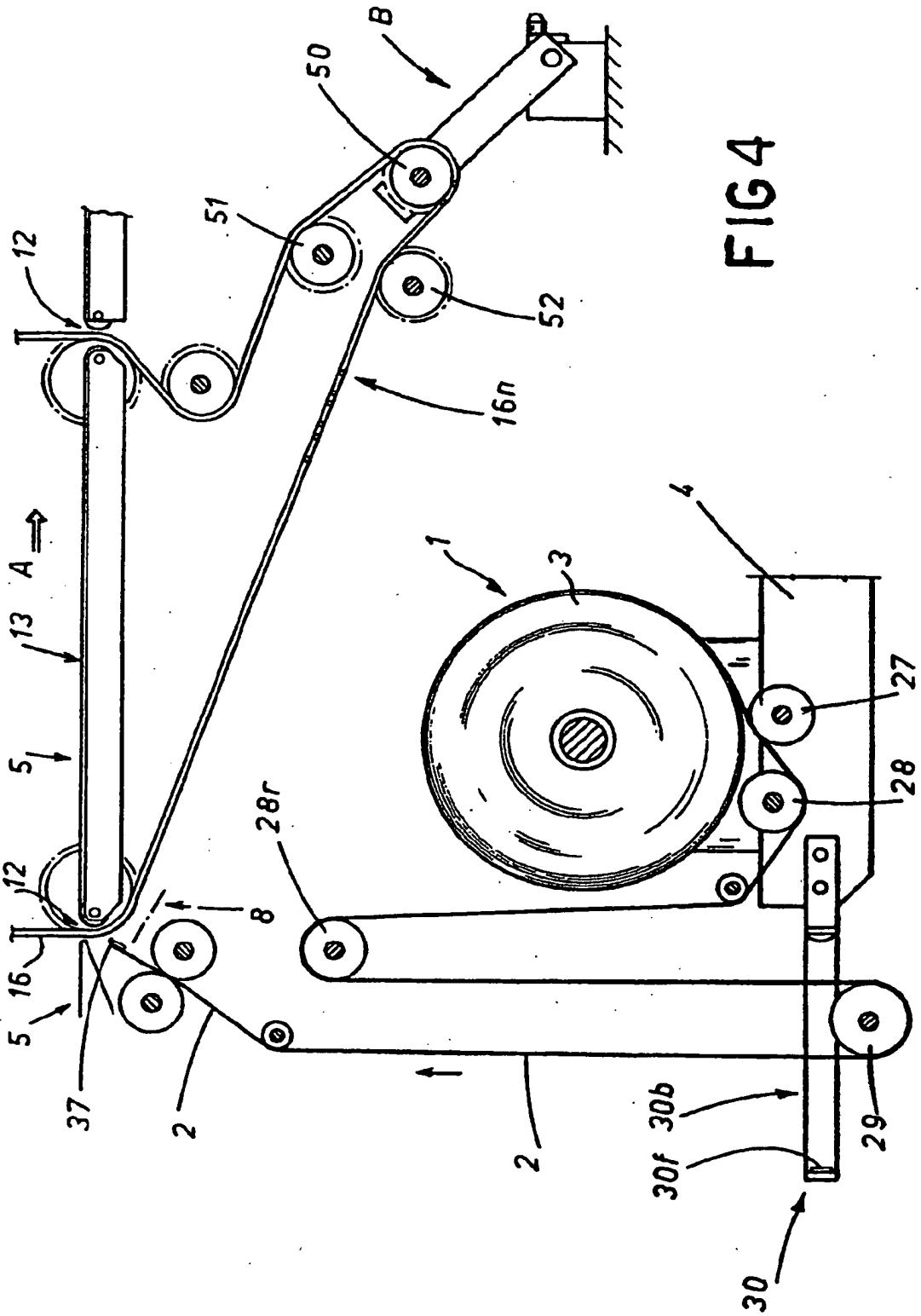
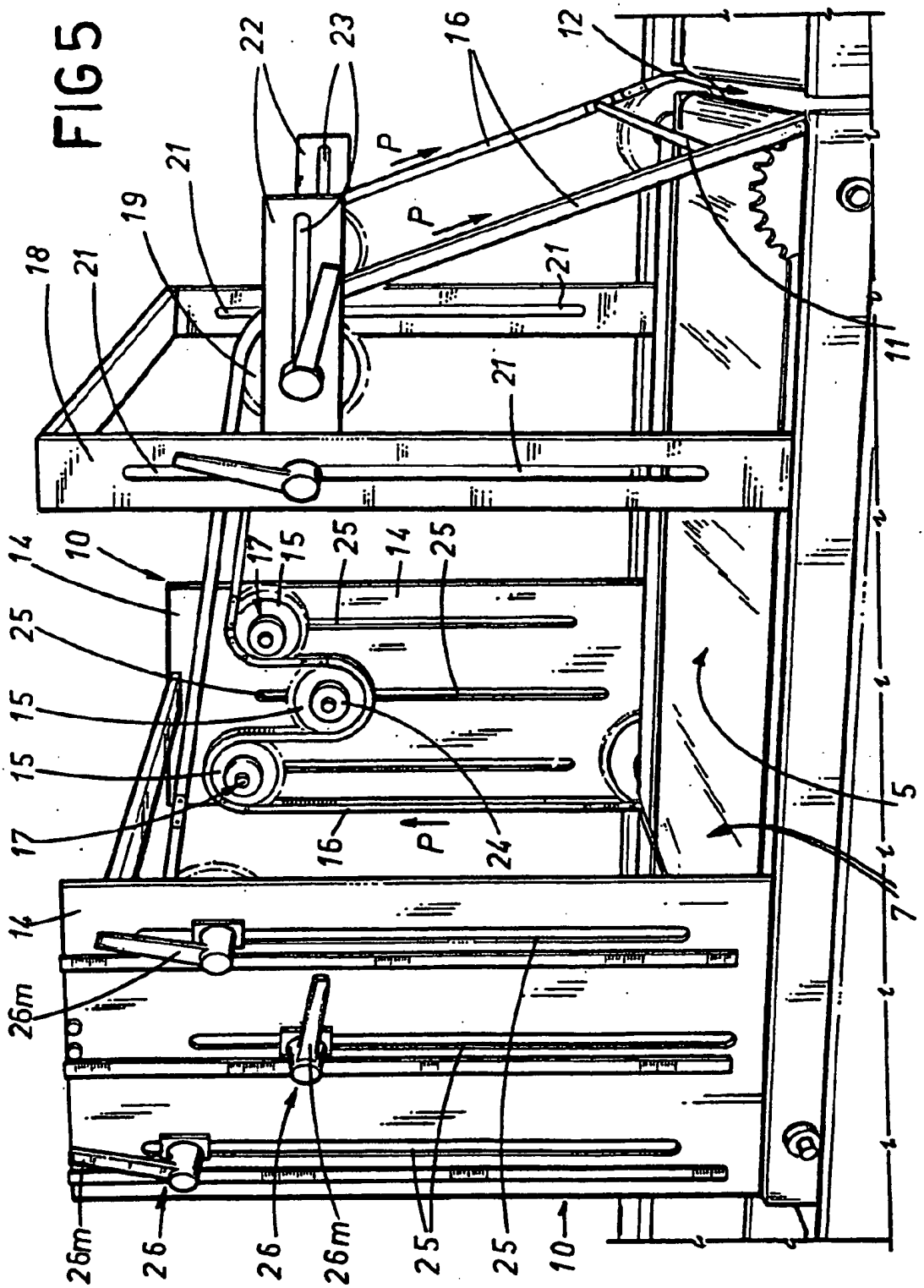


FIG4

FIG5



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EUROPEAN SEARCH REPORT

Application Number
EP 93 83 0324

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	GB-A-2 182 630 (M. GAMBETTI) * page 3, line 70 - page 4, line 5; figures *	1	B65B11/10
A	GB-A-1 355 466 (M. BURNSIDE) * page 3, line 55 - page 4, line 21; figures *	1	
A	US-A-4 083 163 (R. GANZ) * column 8, line 39 - column 10, line 60; figures *	1	
A	EP-A-0 049 377 (GANZ BROTHERS)		
A	EP-A-0 229 452 (MEAD CORPORATION)		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 November 1993	JAGUSIAK, A

CATEGORY OF CITED DOCUMENTS

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